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Duration of Service after Overweight-related Diagnoses, Active Component, U.S. Armed Forces, 1998-2010

Each U.S. military service conducts physical fitness and body weight/body fat assessments to monitor the physical fitness, military bearing, and overall health of its members. Service-specific policies prescribe reconditioning programs (e.g., structured physical fitness training, nutritional counseling) for service members who fail to meet weight standards. While service members are out of compliance with weight standards, they may be ineligible for reenlistment, promotions, career-enhancing assignments, and military professional training; eventually, they may be discharged from service.

In January 2011, the MSMR summarized numbers, rates, and trends of overweight-related diagnoses during medical encounters of active component members over the past 13 years.[1] During the 13-year period, the percent of active component members with overweight-related diagnoses steadily increased. From 2003 through 2008, the rate of increase generally accelerated; however, from 2008 through 2010, the numbers of new cases per year remained fairly stable. Thus, in the past three years, the increase in the proportion of service members who were ever diagnosed as overweight/obese reflected to a large extent increasing numbers of service members who continued in service despite recurrent overweight-related diagnoses.

This report summarizes the demographic and military characteristics of active component members who have received clinical diagnoses of overweight/obesity, estimates the lengths of service (and recent trends) from the time of first diagnoses of overweight/obesity until termination of active service, and estimates losses of active component manpower due to early termination of service of overweight/obese military members.

Methods:

The surveillance period was 1 January 1998 to 31 December 2010. The surveillance population included all individuals who served in the active component of the U.S. Armed Forces any time during the surveillance period. Records of all outpatient encounters of active component members in fixed U.S. military and some non-military (i.e., purchased care) medical facilities were searched to identify U.S. military members with diagnoses specific for or suggestive of "overweight/obesity." All records used for the analysis are routinely maintained in the Defense Medical Surveillance System.

Events of interest for this analysis were outpatient encounters with diagnoses (in any diagnostic position) that are specific for or suggestive of "clinical overweight." For surveillance purposes, a case of overweight or obesity was defined by a record of an outpatient encounter with a diagnosis of "overweight or obesity" (ICD-9-CM: 278.00-278.02); a V-coded diagnosis indicating a body mass index above 25 kg/m^2 for adults (ICD-9-CM: V85.2-V85.4); or a pediatric body mass index above the 85th percentile for persons younger than 20 years (ICD-9-CM: V85.53, V85.54).

On 1 October 2005, the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) extended the scope of the clinical description of ICD-9-CM: 278.0 from "obesity" to "overweight and obesity"; added a five-digit code that differentiated "overweight" (ICD-9-CM: 278.02) from "obesity, unspecified" (ICD-9-CM: 278.00) and "morbid obesity" (ICD-9-CM: 278.01); and added a new code series (V85) that enabled reporting of body mass indices (BMI) by categories, i.e., underweight, normal, overweight, obese, and morbid obese. Thus, before October 2005, service members who were overweight, but not obese, may have received diagnoses of ICD-9-CM: 278.0 "obesity" (the only overweight-related ICD-9-CM code available at the time); however, after October 2005, service members who were overweight, but not obese, may have received an overweight-specific diagnosis of ICD-9-CM: 278.02 "overweight". Thus, for this report, some analyses were restricted to 2006 through 2010 to account for the broader scope and greater specificity of overweight-related diagnosis codes during the last five years compared to prior years of the period.

The Kaplan-Meier survival method was used to document percentages of service members who were still in active service at various times after initial overweight-related diagnoses. Differences in the durations of active service between those with and without overweight-related diagnoses were assessed by comparing the survival experiences of "cases" and contemporaneous matched controls (matched to cases on age, gender, and branch of military service). For survival analyses, follow-ups began (survival time=0) on the day of the first reported overweight-related diagnosis for each case and on the corresponding date for each case's control. Each case and control was followed until the day he/she terminated active military service or the last day of the surveillance period.

"Excess losses" from active service at various times after initial overweight-related diagnoses were estimated by multiplying the total number of service members in each case cohort of interest by the differences in the percentages of cases and controls still in active service at various follow-up times of interest (i.e., 1,2,3,4,5 years).

Results:

During the surveillance period, 382,448 active component members received at least one overweight-related diagnosis

Figure 1a. Cumulative probablilities of remaining in active service, by time since first overweight-related diagnosis, among cases and contemporaneous matched controls, active component, U.S. Armed Forces, 1998-2010

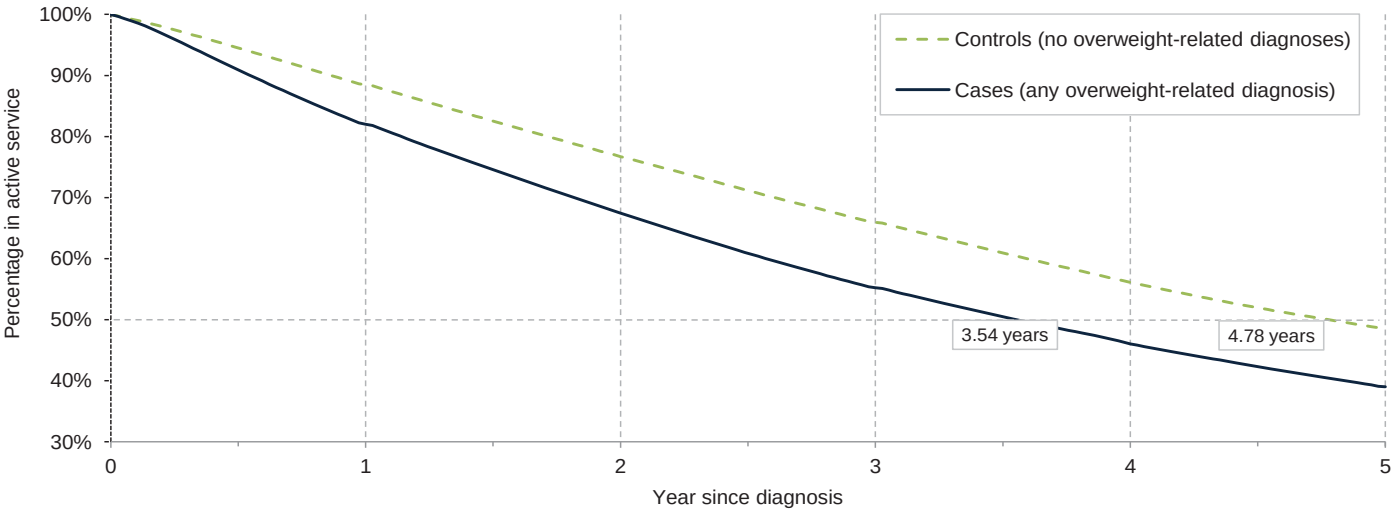
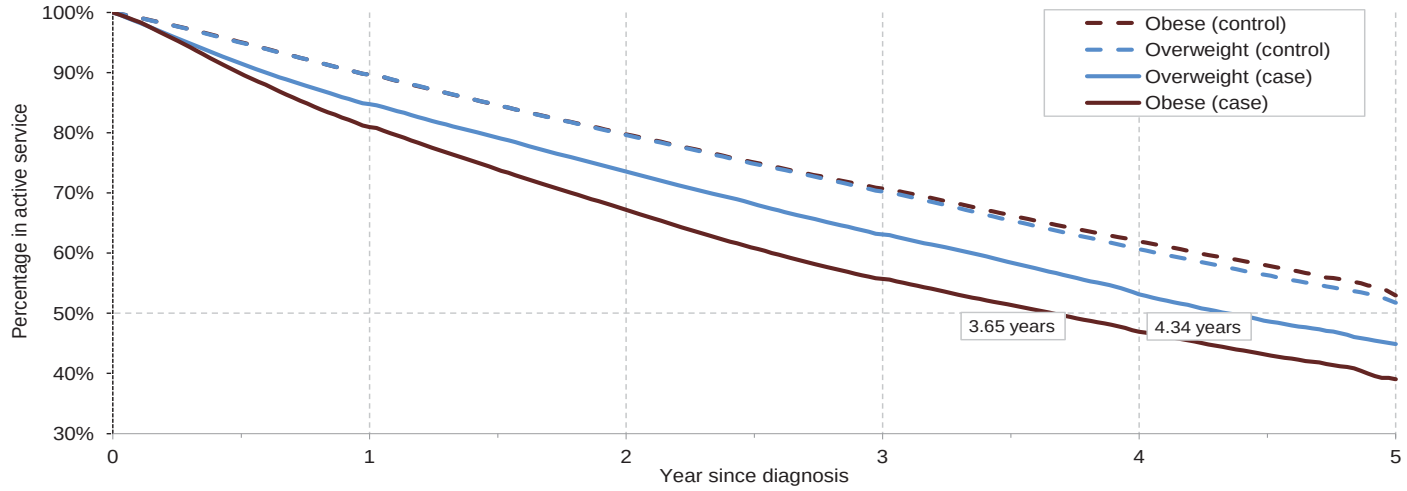


Figure 1b. Cumulative probablilities of remaining in active service, by time since first diagnosis of obesity or overweight, among cases and contemporaneous matched controls, active component, U.S. Armed Forces, 2006-2010



during an outpatient medical encounter **(Table 1).** The median duration of active service after initial overweight-related diagnoses (3.54 years) was 15 months shorter than that of contemporaneous matched controls **(Table 1, Figure 1a).**

Between 2006 and 2010, the median duration of service was approximately eight months shorter among those with incident obesity (3.65 years) compared to overweight (4.34 years) diagnoses; both obesity and overweight cases had markedly shorter durations of service than their respective controls **(Figure 1b).**

After initial overweight-related diagnoses, median durations of service were similar among males and females; however, males compared to females had much larger deficits of active service (relative to their respective controls) after obesity and overweight diagnoses **(Table 1).**

After overweight-related diagnoses, durations of service (medians) were more than twice as long among those 30-34 years old compared to those older than 40 or aged 20-24 years old **(Table 1).** The largest deficits of active service after overweight-related diagnoses (relative to their respective controls) affected 25-29 year olds (difference in median duration of service [diff median duration]: 2.63 years); the smallest deficits of active service after overweight-related diagnoses affected teenaged service members (diff median duration: 0.46 years) **(Table 1).**

Among racial-ethnic subgroups, durations of service (medians) after overweight-related diagnoses were shortest among Hispanic and longest among Asian/Pacific Islander service members. The largest and smallest deficits of active service after overweight-related diagnoses (relative to their respective controls) affected Hispanic (diff median duration: 2.61 yrs) and black, non-Hispanic (diff median duration: 1.12 yrs) service members, respectively **(Table 1).**

Among the Services, durations of service (medians) after overweight-related diagnoses were shortest among Marine Corps and longest among Air Force and Coast Guard

Table 1. Median years of active service after overweight-related diagnosis (relative to contemporaneous controls), 1998-2010

	No. with an overweight-related diagnosis	Years (median) of active service after overweight-related diagnosis		Difference in years (median) of active service after overweight-related diagnosis
	No.	Case	Control	Case vs. control
Total	382,448	3.54	4.78	1.24
Sex				
Male	291,278	3.56	5.07	1.51
Female	91,170	3.49	4.05	0.56
Age group				
<20	27,346	3.47	3.92	0.46
20-24	129,972	2.79	3.85	1.06
25-29	84,680	4.27	6.91	2.63
30-34	49,816	6.77	8.28	1.51
35-39	49,698	3.94	5.20	1.25
>40	40,936	2.39	3.35	0.97
Race/ethnicity				
White,non-Hispanic	259,230	3.43	4.70	1.26
Black,non-Hispanic	80,140	3.92	5.04	1.12
Hispanic	3,892	1.76	4.36	2.61
American Indian/ Alaskan Native	5,867	3.22	4.41	1.20
Asian/Pacific Islander	11,115	4.62	5.77	1.15
Other	22,204	3.86	5.35	1.49
Service				
Army	174,934	3.08	4.29	1.21
Air Force	107,043	4.59	5.61	1.02
Marine Corps	20,981	2.28	3.71	1.43
Navy	71,495	3.72	5.07	1.35
Coast Guard	7,995	5.09	7.78	2.68
Military status				
Enlisted, junior	198,894	2.85	3.68	0.84
Enlisted, senior	150,581	4.49	5.79	1.30
Officer, junior	18,803	6.76	8.44	1.68
Officer, senior	14,170	4.08	5.97	1.89
Military occupation				
Combat-related[a]	41,779	2.75	4.16	1.42
Motor transport	8,934	2.87	4.09	1.21
Aviation/aviation support	5,545	4.92	7.26	2.33
Repair, engineer	111,269	3.60	4.83	1.23
Communications/ intelligence	94,929	3.40	4.54	1.15
Health care	43,735	4.05	5.06	1.00
All other/not specified	76,257	3.81	4.95	1.14

[a]Armor, infantry, artillery, combat engineer
[b]Pilot, aircrew, air traffic

members, respectively **(Table 1, Figure 2).** The largest deficits of active service after overweight-related diagnoses (relative to their respective controls) affected Coast Guard members (diff median duration: 2.68 years); the smallest deficits of service after overweight-related diagnoses affected Air Force (1.02 years) members **(Table 1).**

In relation to the military occupations of service members, durations of service (medians) after overweight-related diagnoses were shortest among those in ground combat-associated occupations (e.g., armor, infantry, artillery combat engineer) and longest among those in aviation/aviation support occupations **(Table 1).** The largest deficits, by far, of active service after overweight-related diagnoses (relative to their respective controls) affected aviation/aviation support personnel (diff median duration: 2.33 years); the smallest deficits of service after overweight-related diagnoses affected healthcare workers (1.00 years) **(Table 1).**

Since approximately 2005, durations of service after overweight-related diagnoses have increased. Among those diagnosed with overweight or obesity during the periods 1998-2001 and 2002-2004, the lengths of time until 25 percent of the cohorts had left service (i.e., 75 % survival times) were very similar (75% survival time: 1998-2001 cohort, 1.30 yrs; 2002-4 cohort, 1.35 years). The 75 percent survival times were progressively longer for the 2005-7 (1.52 yrs) and 2008-10 (1.71 yrs) cohorts **(Figure 3).**

By the third year after initial overweight-related diagnoses (relative to the experience of contemporaneous matched controls), there were deficits of 41,235 overweight/obese cohort members in active service **(data not shown).** Among the Services, the manpower deficits that may have been directly (e.g., military operational effectiveness) or indirectly (e.g., military administrative actions) related to overweight/obesity were largest in the Army and smallest in the Coast Guard **(Figure 4).**

Editorial comment:

In recent years, there has been increasing interest regarding the "epidemic of obesity" in the U.S. general population – particularly, among adolescents and young adults. The national defense implications of the obesity epidemic are concerning. For example, overweight/obesity is the most frequent medically disqualifying condition among civilian applicants for military service. As more military-aged civilians become ineligible for service because of overweight, it will be increasingly difficult to meet induction requirements without lowering standards. This report extends concerns regarding the military operational impacts of overweight/obesity by documenting some deleterious effects of overweight/obesity on active force strength.

During the 13-year period reviewed for this report, 382,448 active component members received an overweight-related diagnosis during at least one medical encounter. The number of service members considered overweight for military administrative purposes was undoubtedly much greater. In addition, the report was limited to members of the active component who received overweight-related diagnoses during medical encounters in fixed (e.g., not deployed, at sea) military medical facilities. As such, the magnitudes, distribution, and impacts of overweight/obesity on total force strength (active and reserve components) are significantly underestimated in this report.

This report compared the median durations of service after initial overweight-related diagnoses in various military and demographic subgroups. Not surprisingly, in general, the

subgroups with the shortest durations of service after initial overweight-related diagnoses were the same as those with the shortest durations of service among matched controls. For this reason, we calculated differences in the median durations of service between overweight/obesity cases and matched controls. These differences are more informative than other measures regarding the impacts of overweight-related diagnoses on active component manpower.

During 2006-2010, the durations of active service after overweight-related diagnoses were approximately 18 months (obesity) and 9 months (overweight) shorter than the active service of their respective counterparts. The largest declines in service longevity after overweight-related diagnoses affected males, 25 to 29-year-olds, Hispanics, Coast Guard members, junior and senior officers, and aviation and aviation support personnel. It is not clear why the service careers of members of these groups were most affected by overweight-related diagnoses. However, overweight/obese members of these groups account for disproportionately large losses of potentially productive military service. Thus, to the extent feasible, reconditioning programs (e.g., physical training, nutritional counseling) that enable overweight but otherwise militarily productive individuals to remain in service should target and be tailored to the specific needs of members of these groups.

This report documents that the cumulative effects of early termination of service after overweight-related diagnoses generally increase throughout the first three years after initial diagnosis. In turn, among service members diagnosed as overweight/obese, the peak deficits in numbers still in

Figure 2. Cumulative probablilities of remaining in active service, by time since first overweight-related diagnosis, by service, 1998-2010

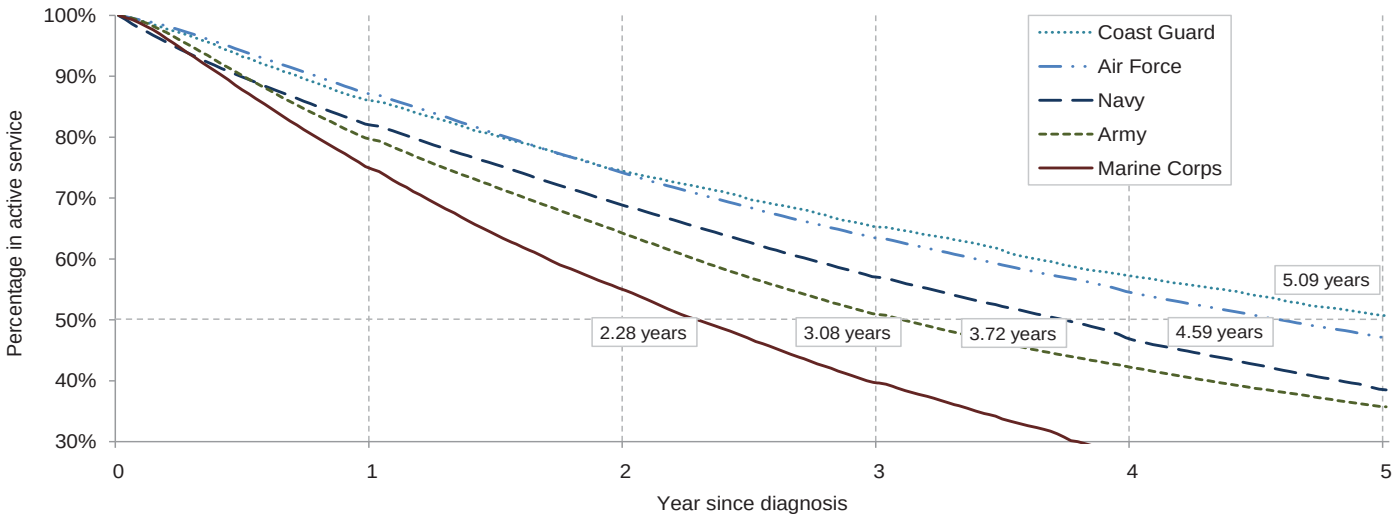


Figure 3. Cumulative probablilities of remaining in active service, by time since first overweight-related diagnosis, by period of diagnosis, 1998-2010

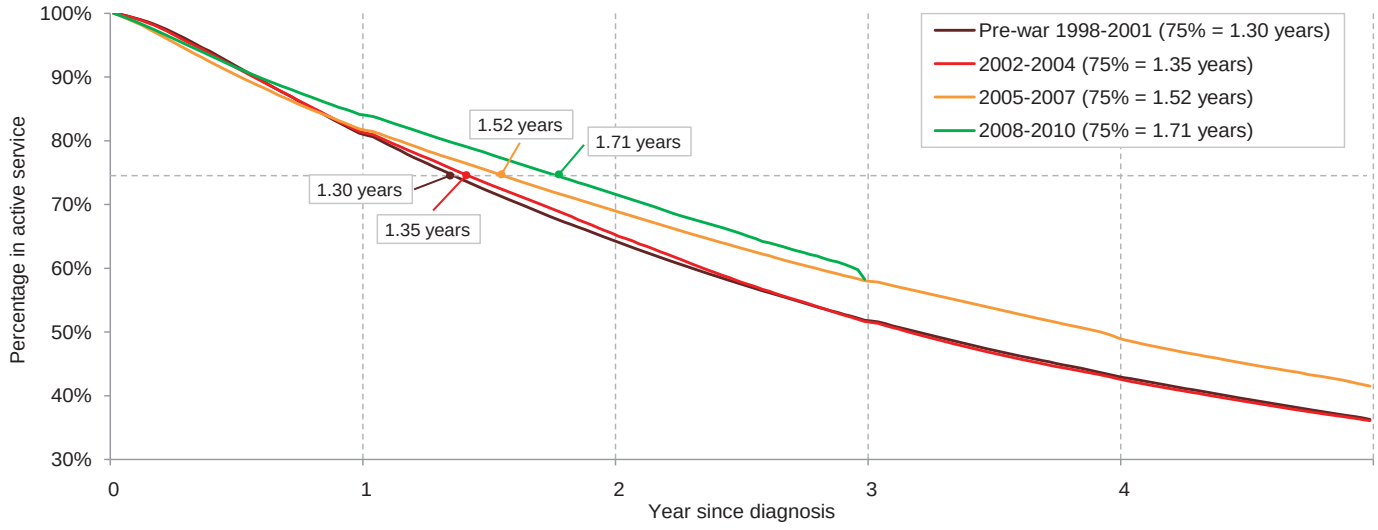
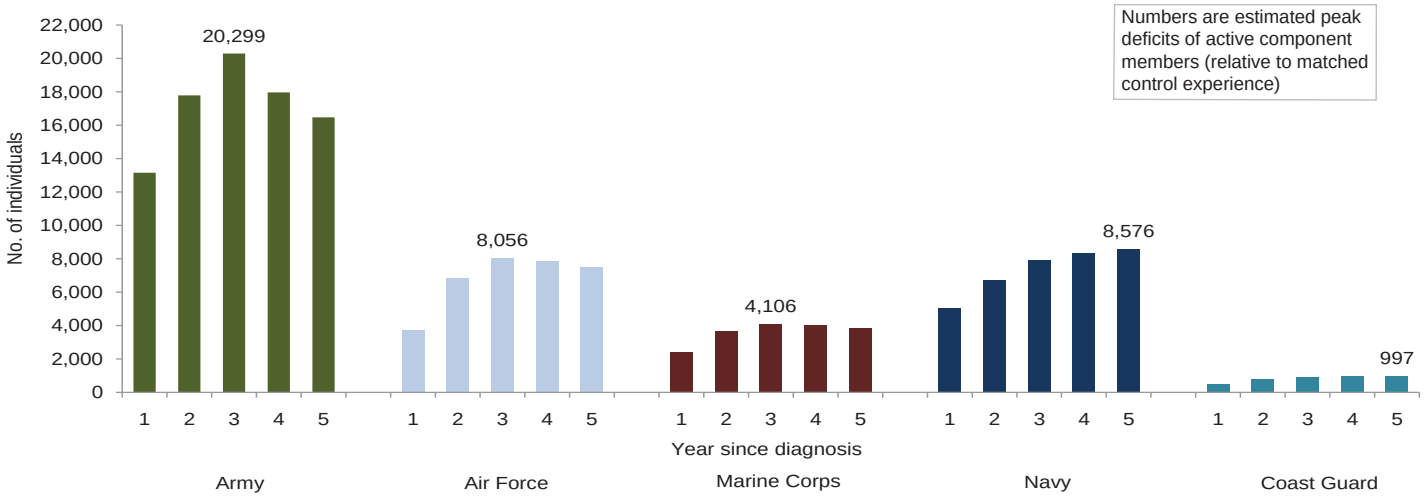


Figure 4. Estimated deficits of active component members due to early terminations of service by individuals with a previous overweight-related diagnosis (relative to the experiences of contemporaneous matched controls), by number of years since first diagnosis, 1998-2010



active service (relative to controls) were approximately three years after initial diagnoses. The finding suggests that service members who remain in service for three years after initial overweight-related diagnoses have longevities of service from that time forward that are generally comparable to their counterparts. The finding implies that such service members are not at significantly greater risk than their counterparts of career-threatening physical (e.g., back, joint disorders) or medical (e.g., diabetes, cardiovascular diseases) conditions that are often associated with chronically poor nutritional health.

Importantly, the report does not consider the reasons for or the settings in which service members were diagnosed as overweight/obese or the reasons that obese or overweight cohort members terminated their active service. To the extent that early terminations of service were not directly related to nutritional status, physical fitness, or related medical conditions, reconditioning programs that focus on these factors would be less relevant and less useful for increasing the longevity of effective military service after overweight-related diagnosis.

Finally, during a period of unprecedented operational demands on U.S. military forces, military medical efforts to prevent debilitating medical conditions and conserve the fighting strength increase in importance. The epidemic of obesity in the general U.S. population is militarily important because it impacts the number and quality of future accessions to military service. However, military medical professionals have limited capabilities to counter the causes or impacts of the obesity epidemic among adolescent and young adult civilians.

However, this report clearly documents the significant impacts on the active force of "nutritional casualties." Such casualties are not directly related to combat service or military-specific activities; nonetheless, they have large and costly impacts on the health, fitness, sense of well-being, and military operational capabilities of the active force. "Nutritional fitness" should be considered a high priority for military clinical prevention and military public health policy and program initiatives and resources.

References:

1. Armed Forces Health Surveillance Center. Diagnosis of overweight/obesity, active component, U.S. Armed Forces, 1998-2010. *Medical Surveillance Monthly Report (MSMR)*.2011 Jan;18(1):7-11.

Noise-induced Hearing Injuries, Active Component, U.S. Armed Forces, 2007-2010

A 2006 Institute of Medicine (IOM) report estimated prevalences of noise-induced hearing loss (NIHL) and tinnitus among U.S. military members from World War II through 2005. The report's authors concluded that military hearing conservation programs (HCP) had not adequately protected the hearing of U.S. service members since at least World War II; they recommended using prospective, longitudinal, epidemiological data to reliably estimate the incidence, prevalence, and severity of NIHL and tinnitus in the U.S. Armed Forces.[1] In a recent report, the U.S. Government Accountability Office (GAO) concluded that the U.S. Department of Defense (DoD) lacked adequate performance indicators of effectiveness of HCPs.[2]

For over a decade, Tri-Service military audiologists and their Department of Veterans Affairs (VA) counterparts worked to standardize outcome metrics for monitoring the effectiveness of HCPs. The collaboration produced ICD-9-CM coding guidelines that established metrics of HCP effectiveness. The new coding standards were designed to improve the quality of data that are used for reporting and tracking prevalences and incidence rates of noise-induced hearing injury.[3]

Noise-induced hearing injury (NIHI) is a broad diagnostic category that encompasses a variety of individual and aggregated ICD-9-CM diagnostic codes **(Table 1).** NIHI-related diagnostic subgroups include tympanic membrane perforation (TMP), sensorineural hearing loss (SNHL), mixed hearing loss (MHL), noise-induced hearing loss (NIHL), significant threshold shifts (STS), tinnitus, and other outcomes.[4] In 2007, analysts at the U.S. Army Center for Health Promotion and Preventive Medicine (now Army Institute of Public Health [AIPH]) developed a watch list for NIHI and comorbidities based on the established coding guidelines; the watch list was intended to guide surveillance of ICD-9-CM diagnostic codes that are indicators of NIHI-associated injuries. A working copy (unpublished) of the current watch list informs both military and VA NIHI surveillance processes.[4]

Since 2005, several epidemiological studies (using ICD-9-CM indicator codes to identify cases) have documented higher rates of NIHL and comorbidities among soldiers returning from deployments in support of operations Iraqi Freedom [OIF]) and Enduring Freedom (OEF) relative to their non-deployed counterparts.[5,6] A 2011 study also reported higher rates of NIHL, tinnitus and comorbidities such as sensorineural hearing loss (SNHL), and significant threshold shifts (STS) among soldiers returning from OEF/OIF compared to others; of note, this study documented higher NIHI rates after January 2007 than before. The recent increase in documented rates of NIHI are likely related at least in part to improvements in active surveillance of NIHI since early 2007.[4]

In 2006 a multidisciplinary team that represented audiology, epidemiology, and other injury-related specialties at the USACHPPM (now AIPH) collaborated with the Armed Forces Health Surveillance Center (AFHSC) to obtain records of medical encounters of U.S. military members that included injury-specific ICD-9-CM diagnosis

Table 1. Diagnosis (ICD-9-CM) and procedural (CPT) codes for noise-induced hearing injury

Group	Code	Description
Eardrum perforation (TMP)	384.20	Perforation of tympanic membrane unspecified
	384.21	Central perforation of tympanic membrane
	384.22	Attic perforation of tympanic membrane
	384.23	Other marginal perforation of tympanic membrane
	384.24	Multiple perforations of tympanic membrane
	384.25	Total perforation of tympanic membrane
	384.81	Atrophic flaccid tympanic membrane
	384.82	Atrophic nonflaccid tympanic membrane
	384.9	Unspecified disorder of tympanic membrane
	385.23	Discontinuity or disorder of ear ossicles
Sensorineural hearing loss	389.10	Sensorineural hearing loss, unspecified
	389.11	Sensory hearing loss, bilateral
	389.15	Sensorineural hearing loss, unilateral
	389.16	Sensorineural hearing loss, asymmetrical
	389.17	Sensory hearing loss, unilateral
	389.18	Sensorineural hearing loss, bilateral
Mixed hearing loss	389.20	Mixed hearing loss, unspecified
	389.21	Mixed hearing loss, unilateral
	389.22	Mixed hearing loss, bilateral
Noise-induced hearing loss	388.10	Noise effects on inner ear, unspecified
	388.11	Acoustic trauma (explosive) to ear
	388.12	Noise induced hearing loss
Significant threshold shift	794.15	Nonspecific abnormal auditory function studies
Tinnitus	388.30	Tinnitus, unspecified
	388.31	Subjective tinnitus
	388.32	Objective tinnitus
Procedures (CPT codes)	92552	Pure tone audiometry (threshold) air only
	92555	Speech audiometry threshold
	92556	Speech audiometry threshold, w/ speech recognition
	92557	Comprehensive audiometry threshold evaluation and speech recognition
	92559	Audiometric testing of groups

codes (including NIHI indicator codes). The data were used to estimate prevalences of NIHI among U.S. military members; the results were reported to the Defense Safety Oversight Council (DSOC) and published in a peer-reviewed medical journal.[7,8] These reports demonstrated the capability of the AIPH and AFHSC to produce recurring reports of the incidence and prevalence of NIHI among actively serving military members; such reports serve as benchmarks against which hearing loss prevention program effectiveness routinely can be measured. The current report summarizes medical encounters of U.S. service members that were documented with NIHI indicator ICD-9-CM diagnosis codes during calendar years 2007 through 2010.

Methods:

The surveillance period was 1 January 2007 to 31 December 2010. The surveillance population included all individuals who served in an active component of the Army, Navy, Air Force or Marine Corps any time during the surveillance period.

NIHI case-defining diagnosis and procedural codes **(Table 1)** were identified by a group of military and VA audiologists with extensive clinical and population health surveillance experience.[3,4,5,6] NIHI cases were ascertained from standardized records of inpatient and outpatient encounters in fixed military and nonmilitary (purchased care) medical facilities that included a NIHI case-defining diagnosis code in any diagnostic position. All records used for the analysis are maintained in the Defense Medical Surveillance System (DMSS) for health surveillance purposes.

Incidence rates were calculated as incident injuries (one per service member per lifetime) per 1,000 person-years (p-yrs) of active component military service. Crude overall NIHI (i.e., any case-defining diagnosis code) and NIHI category-specific incidence rates were calculated for U.S. military members overall and for each service.

Results:

During the four-year surveillance period, the most frequently diagnosed indicators of noise-induced hearing injuries were tinnitus, sensorineural hearing loss, and significant threshold shift. On average, throughout the period, there were nearly 15,000 new tinnitus cases diagnosed each year (mean, per year: 14,962). From the first to the last year of the period, annual numbers and rates of tinnitus increased by 42 percent and 35 percent, respectively **(Figure 1)**.

Incidence rates of sensorineural hearing loss and significant threshold shift sharply increased during the last

Figure 1. Annual numbers and incidence rates of noise-induced hearing injuries, active component, U.S. Armed Forces, 2007-2010

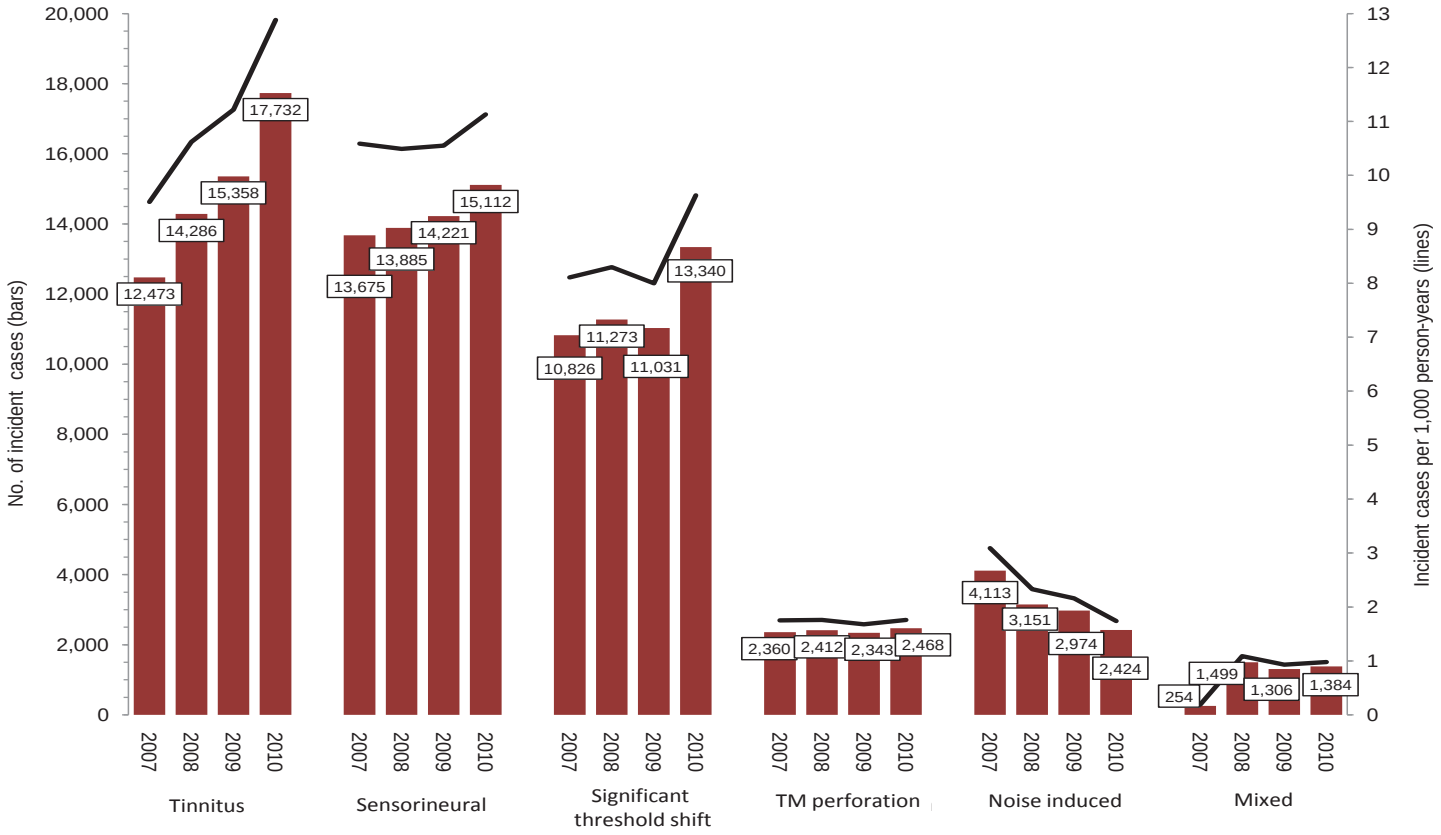


Table 2. Incident cases and rates of noise-induced hearing injuries (NIHI), by military and demographic characteristics, active component, U.S. Armed Forces, 2007-2010

	No. (rate[a]) 2007	No. (rate[a]) 2008	No. (rate[a]) 2009	No. (rate[a]) 2010
Gender				
Male	31,440 (27.0)	31,289 (26.5)	30,527 (25.4)	33,103 (27.3)
Female	2,683 (13.7)	2,817 (14.4)	2,893 (14.5)	3,067 (15.1)
Age group				
<20	1,490 (12.1)	1,255 (10.1)	1,181 (9.9)	1,123 (10.1)
20-24	8,653 (18.4)	8,954 (18.9)	8,737 (18.3)	9,467 (19.7)
25-29	6,704 (23.0)	6,889 (22.7)	6,895 (21.6)	7,743 (23.4)
30-34	4,301 (22.6)	4,422 (23.1)	4,192 (21.3)	4,574 (22.5)
35-39	5,058 (31.3)	4,960 (30.7)	4,780 (29.5)	5,018 (31.4)
>=40	7,917 (64.7)	7,626 (61.5)	7,635 (59.3)	8,245 (62.6)
Occupational group				
Enlisted				
Infantry, gun crew, seaman	7,888 (38.3)	8,306 (39.2)	7,908 (38.7)	8,211 (41.2)
Electronic equipment repairer	1,728 (19.3)	1,576 (17.9)	1,587 (17.6)	1,818 (18.5)
Communications, intelligence	2,650 (24.1)	2,829 (25.5)	2,659 (24.2)	2,785 (25.2)
Healthcare	1,722 (21.7)	1,778 (22.6)	1,650 (20.7)	2,021 (24.2)
Technical, other professional	906 (25.2)	1,006 (26.7)	1,055 (27.1)	1,136 (28.5)
Functional support, admin	3,486 (20.2)	3,370 (19.5)	3,348 (19.3)	3,459 (20.5)
Electrical/mechanical repair	5,243 (22.5)	5,033 (21.7)	4,694 (20.1)	5,335 (22.7)
Craftswork, construction	1,057 (25.4)	954 (23.6)	962 (23.2)	1,020 (24.3)
Service, transport, supply	2,923 (26.1)	3,087 (26.3)	3,452 (24.8)	4,004 (27.3)
Students, trainees	1,154 (19.9)	846 (13.1)	719 (11.1)	758 (12.9)
Officers				
General/flag rank, executives	122 (64.0)	120 (63.2)	107 (55.5)	99 (50.4)
Tactical operations	1,808 (22.4)	1,863 (23.1)	1,869 (22.8)	1,954 (23.3)
Intelligence	310 (24.1)	336 (25.6)	348 (25.8)	307 (21.4)
Engineering, maintenance	864 (27.1)	741 (24.3)	816 (26.3)	890 (28.2)
Scientists, professionals	339 (26.3)	342 (26.3)	385 (28.9)	340 (24.8)
Healthcare	906 (25.8)	920 (25.9)	870 (24.1)	867 (23.4)
Administrative	382 (27.3)	338 (23.9)	376 (25.2)	418 (27.5)
Supply, logistics	448 (25.6)	456 (24.5)	432 (22.7)	562 (28.6)
Students, trainees, other	187 (12.0)	205 (12.8)	183 (11.3)	186 (11.6)

[a]Rate per 1,000 person-years of active component military service

year of the period. Between 2007 and 2010, cases per year of sensorineural hearing loss and significant threshold shift increased by 11 percent and 23 percent, respectively **(Figure 1).**

Annual numbers and rates of TM perforation remained remarkably stable throughout the period (range, cases per year, 2007-10: 2,343-2,468); and numbers and rates of hearing loss of "mixed" type remained fairly stable during the last three years of the period (range, cases per year, 2008-10: 1,306-1,499) **(Figure 1).**

Numbers and rates of noise-induced hearing loss steadily declined from 2007 through 2010; there were approximately 40 percent fewer cases in 2010 (n=2,424) than in 2007 (n=4,113) **(Figure 1).**

Throughout the period, rates of noise-induced hearing injuries were markedly higher among males than females and increased with age. In general, rates were more than five-fold higher among service members 40 years and older compared to those younger than 20 years **(Table 2).**

Among enlisted service members, rates of noise-induced hearing injuries were markedly higher among those in combat-specific occupations (e.g., infantry, gun crew, seaman) than any others. Among officers, the highest rates were among the most senior in rank (e.g., general/flag/executives); undoubtedly, the finding reflects the relatively older age of this group compared to others. Rates did not markedly change over the four-year period in any demographic or military occupational subgroup **(Table 2).**

Editorial comment:

In general, the numbers and rates of noise-induced hearing injuries (NIHI) reported here are consistent with those reported in a recent study of postdeployment NIHI through June 2009.[4] Also, the relationships of rates in various demographic subgroups reported here are consistent with findings of other studies.[7,8,9,10]

Following the publication in January 2010 of baseline noise-induced hearing injury prevalences and rates (based on records routinely maintained in the DMSS)[8], a multidisciplinary team at the Army Institute of Public Health began collaborating with analysts at the AFHSC to draft a new set of reports on incidence and prevalence of NIHI in the active components of U.S. Armed Forces for the years 2007 through 2010. This period marked a significant improvement in NIHI ICD-9-CM data quality. The emerging reporting capability responds to recommendations of both the IOM and GAO regarding the collection and reporting of estimates of incidence and prevalence of noise-induced hearing loss (NIHL) and tinnitus in military members.[1,2]

The new reports will be generated on a recurring basis and disseminated to medical and command stakeholders at all levels of command, including individual services' reports by installations. The reports are intended to enhance

communication among hearing loss prevention stakeholders as to the effectiveness of NIHI prevention strategies, enable monitoring of progress-based metrics for reducing incidence and prevalence of NIHI over time, and guide development of future prevention intervention efforts.

Reported by: Thomas M. Helfer, PhD, USAPHC (Prov) AIPH. The author acknowledges Dr. Michelle Canham-Chervak and COL Dave Hilber of USAPHC (Prov) and MAJ Christopher Perdue of AFHSC for their support in developing this new NIHI surveillance capability.

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Acute Gastroenteritis Outbreak at the Armed Forces Retirement Home, Washington, DC, January 2011

Diarrhea is a persistent threat to individuals who live in close proximity in settings such as military barracks and encampments (e.g., deployments, field training exercises), sleeping quarters on ships, group residences and nursing homes, and college dormitories. Diarrhea outbreaks in institutional settings are more frequent during winter months.

In the United States, there are approximately 1.5 million nursing home residents; of these, 88 percent and 45 percent are older than 65 and 85 years, respectively.[1] The elderly are at a relatively high risk of adverse outcomes from gastroenteritis. Van Asten and colleagues recently documented significant increases in morbidity, hospitalizations, and deaths during gastroenteritis outbreaks among the elderly.[2] In 2003, Frenzen reported that residents of long-term care facilities (LTCFs) accounted for less than one percent of the U.S. population but 17 percent of all deaths due to gastroenteritis of unknown etiology; nursing home residents were more than four times more likely to die from gastroenteritis of unknown etiology than other elderly.[3]

In the United States, noroviruses cause an estimated 21 million cases of gastroenteritis per year and at least 50 percent of all reported gastroenteritis outbreaks; they are the most common cause of gastroenteritis of known etiology. From 1994 to 2006, the CDC documented 660 laboratory confirmed norovirus outbreaks; more than one-third (n=234, 35%) of the outbreaks occurred in LTCFs.[4]

Advances in laboratory testing have improved the detection, reporting, and characterization of norovirus outbreaks. Norovirus strains are differentiated by genogroup and genotype. Genogroup II-genotype 4 (GII.4) strains were linked to relatively large numbers of outbreaks overall – and 43 percent of outbreaks in LTCFs – during the winters of 2002-2003 and 2006-2007.[4] Genogroup I and II strains have often been associated with restaurant (38%) and party event-related (37%) outbreaks.[5]

The Armed Forces Retirement Home (AFRH) provides residential care and extensive support services for U.S. military veterans. Veterans are eligible to become AFRH residents if they are at least 60 years old and served 20 or more years of active military service (at least 50% in enlisted, warrant officer, or limited duty officer grades); unable to earn a livelihood due to a service-connected disability; unable to earn a livelihood due to injuries, disease, or disability and served in a war theater or received hostile fire pay; or are female and served prior to 1948.[6]

The AFRH operates campuses in Gulfport, Mississippi and Washington, D.C. The Washington DC campus occupies 272 acres and functions as a "city within a city." All requirements of daily living are available on the campus; however, residents may leave the campus as they desire.

The King Health Center is a 200-bed medical facility that provides primary, intermediate and skilled health care to residents of the Washington, DC AFRH. During the last week of January 2011, there was a notable increase in cases of diarrhea with nausea and vomiting among residents of the Center; eventually, the outbreak spread to staff members. This report describes the response to the outbreak by the Preventive Medicine Department at Walter Reed Army Medical Center. The report also summarizes findings of the outbreak investigation and recommendations to improve public health responses to gastroenteritis outbreaks among elderly individuals in institutionalized settings.

Methods:

On 31 January 2011 (six days after symptom onset in the first cases of gastroenteritis among AFRH, Washington, D.C. residents), the staff of the AFRH requested assistance from the Preventive Medicine Department at Walter Reed Army Medical Center. The resulting epidemiologic investigation generally followed the CDC's ten-step process for disease outbreak investigations.[7] Maryland Department of Health and Mental Hygiene interview questionnaires and line listing forms were used to collect relevant information in a standardized way.[8] For analysis purposes, a case of gastroenteritis was defined as a resident or staff member of the AFRH with a history of nausea, vomiting, or diarrhea during the outbreak period.

The investigation team included Army public health nurses and environmental health technicians. During their on-site assessment, the team reviewed case histories, diet histories (based on anecdotal information), and observations of medical staff members who cared for affected residents. Interviews of cases were limited to affected staff members because most affected residents were unable to give reliable information regarding potential risk factors. Detailed food histories were not collected because recollections of food and beverages that had been consumed as long as seven days prior to the investigation were not thought to be reliable. Stool samples were collected from affected residents and several staff members. Public health nurses visited inpatient units and interviewed housekeeping staff regarding sanitation practices. Environmental health technicians inspected the kitchen and dining facility that served the residents, staff, and

visitors of the facility. Kitchen managers were interviewed to determine if any food handlers had been sick (none), and menus for the days preceding the outbreak were reviewed.

Public health officials from surrounding communities (District of Columbia; Montgomery County and Prince Georges County, Maryland) were questioned about gastrointestinal illness outbreaks in their communities. The DoD's Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) was used to assess rates and trends of acute gastrointestinal illness-related encounters at military facilities throughout the national capital area.

Results:

From late January through early February 2011, the average census of the King Health Center was 210 residents; most residents were male, and all were older than 65 years. The staff of the long-term care facility included 73 certified nursing assistants (CNAs), 33 licensed practical nurses (LPNs), 17 registered nurses (RNs) (10 were managers), five security guards, three dietitians, two social workers, three occupational therapists, and five recreation therapists.

Other medical staff members (e.g., from the clinic in another residential building) occasionally worked in the long-term care facility (e.g., made rounds on their patients there). Only one of these staff members reported case-defining symptoms during the outbreak period.

The first cases of the outbreak presented the evening of 25 January; the last outbreak-associated cases presented on 9 February. The most cases (n=13) in any day were on the first day (25 January) of the outbreak period. No individual was identifiable as the index case; no staff member was among the cluster of cases that presented on the first day **(Figure 1)**.

Table 1. Symptom distribution among ill residents and staff at the AFRH, Washington, DC

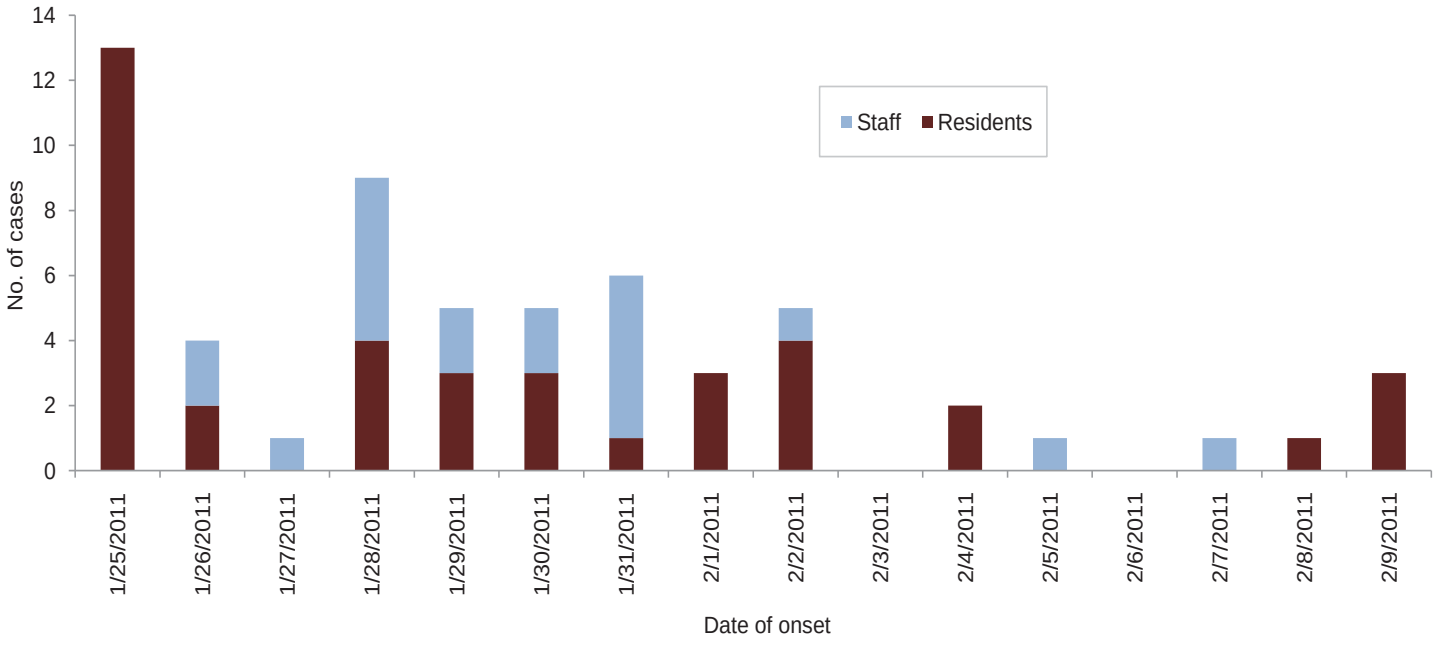
	Residents		Staff	
	(n=36)	% total	(n=23)	% total
Diarrhea	29	80.5	15	65.2
Nausea	4	11.1	10	43.4
Vomiting	24	66.6	19	82.6
Abdominal cramps	2	5.5	7	30.4
Fever	2	5.5	4	17.3
Muscle aches	--	--	4	17.3
Headache	--	--	4	17.3
Chills	--	--	5	21.7

In total, 59 individuals reported case-defining symptoms of nausea, vomiting and/or diarrhea during the outbreak period. Attack rates (AR) were similar among residents (n=36; AR: 17%) and staff members (n=23; AR: 16.3%). Abdominal cramps, fever, muscle aches, headache, and chills were also reported among those affected **(Table 1)**.

Seven (64%) of 11 stool samples from affected residents were positive for norovirus. (Results of analyses of stool samples of staff members were not available for this report.)

No geographic patterns of spread were indicated by the distribution of cases. Cases occurred on all floors of the building, and no units or wings were exclusively affected or spared. In the days preceding the outbreak, there were no reports of visitors who were ill, and no staff members called in sick with gastrointestinal illnesses.

Figure 1. Onset of symptoms of gastrointestinal illness among residents of the AFRH, Washington, DC, 25 January-9 February, 2011



During the facility walk-through, no major deficiencies that would likely contribute to the outbreak were identified. The staff had already implemented a thorough cleaning of high-touch surfaces (e.g., door and faucet handles, elevator buttons, handrails, keyboards, telephones) using products (i.e., quaternary ammonium tuberculocidal disinfectants) recommended in CDC guidelines. Hand sanitizer was readily available at locations throughout the facility. Restrooms were clean, well-maintained, and adequately supplied with paper towels and soap dispensers.

There were no recent or concurrent norovirus outbreaks in the local area. One neighboring county health department reported norovirus activity at its usual background rate; no epidemiologic links to the AFRH outbreak were discernible. No increases in clinic visits for gastroenteritis at military hospitals and clinics in the national capital area were detected (per the ESSENCE database).

Editorial comment:

The outbreak at the Washington DC retirement home for military veterans described in this report exemplifies the typical pattern of norovirus-related outbreaks in closed residential settings. In this outbreak, the index case was not readily identifiable, and no norovirus outbreaks were known to be occurring in surrounding or nearby communities. Because the source of the norovirus could not be determined, the epidemiologic assessment concluded that norovirus was introduced into the AFRH as a point source by an unknown means; it then widely spread among the residents and eventually to the staff. Deficiencies of hand washing were not documented during the epidemiologic investigation; however, inadequate hand washing practices often enable efficient person-to-person transmission of enteric pathogens such as noroviruses.

In this case, there was a lag of approximately six days between the start of the outbreak and the call for assistance from public health professionals from Walter Reed Army Medical Center. Of importance, the AFRH staff initiated all appropriate disease control interventions prior to requesting assistance. Still, the delayed notification hindered the outbreak investigation; for example, it prevented the team from collecting food samples from the facility kitchen for testing and informed the decision not to collect food histories by questionnaire from those affected. Earlier intervention might have enabled identification of the source of the infection; such knowledge might have led to more specific and targeted countermeasures.

Several lessons were learned or re-enforced during this investigation. For example, the importance of regular engagement and open lines of communication between public health agencies and supported communities was reiterated. Also, the investigation highlighted the importance of ongoing monitoring and rapid detection of excessive numbers of cases of various conditions; timely responses to suspected outbreaks of communicable disease; and expeditious consultation with supporting health authorities when infectious disease outbreaks are suspected. In the case of suspected enteric infectious disease outbreaks, detailed histories, clinical assessments, and stool sampling of initial cases are important to document the cause, potential sources, and possible routes of spread.

Illnesses due to noroviruses are generally self-limiting in healthy adults. However, clinical effects can be severe in older individuals, especially those with significant co-morbidities (such individuals are relatively more likely to reside in LTCFs). The AFRH outbreak was relatively short-lived (approximately two weeks in duration) and affected relatively few severely disabled residents. There were no deaths attributable to the outbreak. Without the expeditious actions taken to contain the spread, it might have affected more individuals and produced more serious consequences.

In this outbreak, cases were detected among the residents of a single building (King Health Center) on the large AFRH campus. The lack of apparent spread to other buildings could have been due to diligent hand washing and other infection control practices in the affected building; of course, some cases may not have been detected among the independent residents elsewhere on the campus.

Knowledge of the sources and modes of spread of agents that cause outbreaks is useful to plan and execute effective countermeasures. For example, other than noroviruses, agents most frequently associated with acute gastrointestinal disease outbreaks include Salmonella, *C. perfringens*, and Campylobacter.[9] Clinical manifestations, transmission dynamics, and other epidemic characteristics significantly vary depending on the causative agent.[10] Such differences highlight the importance of implementing and enforcing rigid infection control measures and collecting stool samples (at least 4-6 for definitive diagnosis) as soon as possible after an outbreak is suspected. Once the infectious etiology of an outbreak is identified, countermeasures should specifically target the causative agent.[11]

Report and editorial comment provided by CPT Dawn A. Collier, BSN, Nurse Corps, US Army; COL Michael K. Bayles, BSN, MPH, Nurse Corps, US Army; LTC John P. Barrett, MD, MS, MPH, Medical Corps, US Army, Walter Reed Army Medical Center, Washington DC.

Acknowledgement: The authors thank the staff of the Armed Forces Retirement Home for their assistance in gathering epidemiological data.

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Surveillance Snapshot: Gastroenteritis-related Hospitalizations, 2001-2010

In 2010, more than one percent of all hospitalizations among active component U.S. military members included a discharge diagnosis of gastroenteritis. The lifetime risk of a gastroenteritis admission for a 20-year-old U.S. civilian has been estimated at one in seven.[1] In the figure below, hospitalizations that included a diagnosis of gastroenteritis in any diagnostic position were summarized by previously described pathogen categories.[1,2]

During the 10-year period, 12,632 individuals experienced 13,164 hospitalizations with a discharge diagnosis of gastroenteritis. Hospitalization rates for all-cause gastroenteritis increased between 2001 and 2002 (88.2 per 100,000 person-years [p-yrs]), declined between 2002 and 2004 (68.7 per 100,000 p-yrs) and followed a generally increasing trend from 2004 to 2010 (84.3 per 100,000 p-yrs). Gastroenteritis from unspecified causes comprised 88% of all gastroenteritis-related hospitalizations during the period (range: 85.4% [in 2010] to 91.0% [in 2002]).

Hospitalizations that included a diagnosis of *Clostridium difficile* increased nearly 3.5-fold between 2001 (1.8 per 100,000 p-yrs) and 2010 (6.1 per 100,000 p-yrs), while rates of other bacteria-caused gastroenteritis were relatively stable during the period (range: 3.4 per 100,000 p-yrs [in 2003] to 5.0 per 100,000 p-yrs [in 2007 and 2010]). During the 10-year period viral and parasitic causes were specified in 0.75 percent and 0.41 percent of all gastroenteritis-related hospitalizations, respectively.

If case-defining diagnoses were restricted to the first three (rather than all eight) diagnostic positions on hospital discharge records, estimates of total gastroenteritis-related hospitalizations would be reduced by 15 percent (n=11,158). Of note in this regard, 7,497 hospitalizations during the 10-year period reported gastroenteritis-specific diagnoses in the primary (first-listed) diagnostic position.

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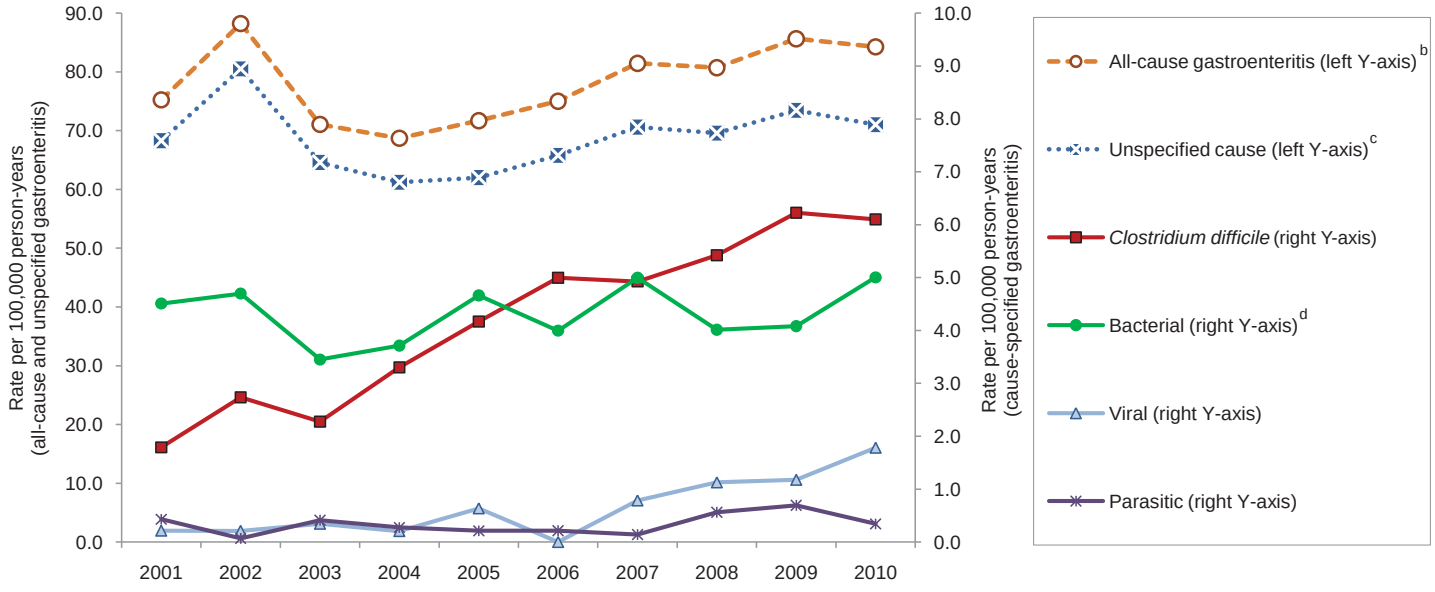
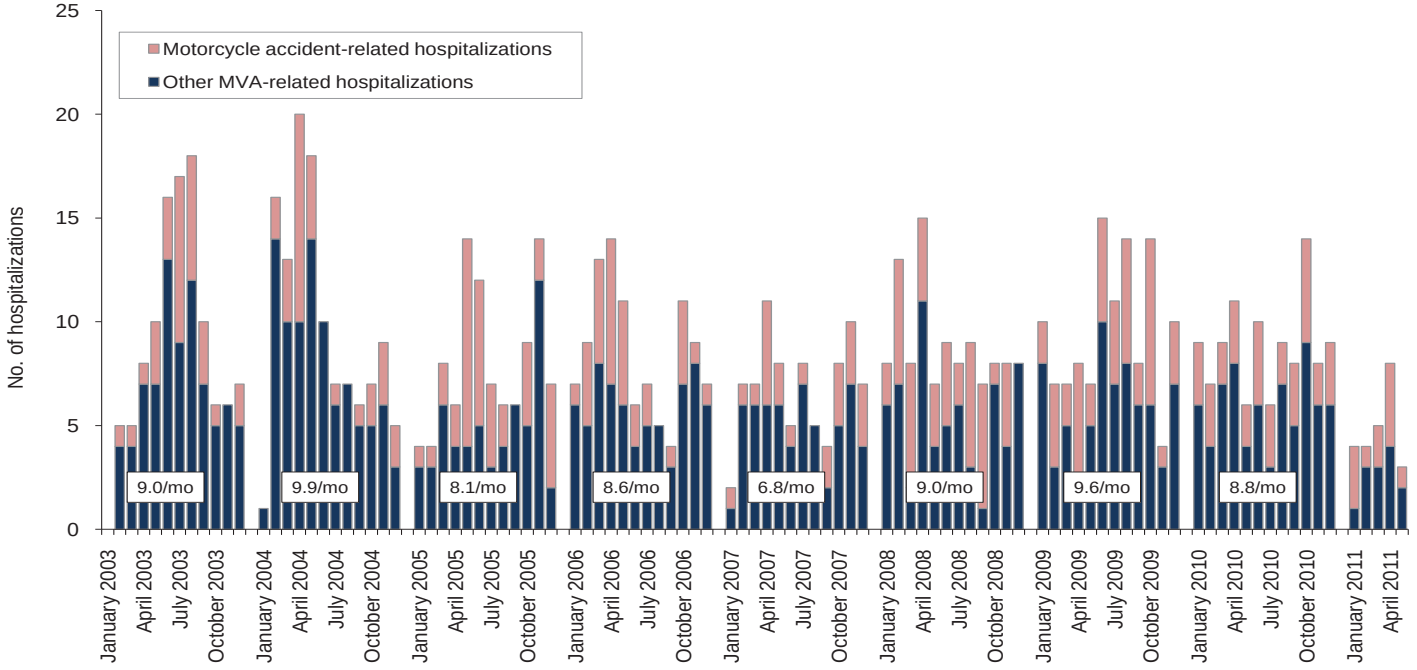
Figure. Gastroenteritis-related hospitalization[a] rates by cause, active component, U.S. Armed Forces, 2001-2010



[a]Hospitalizations with a diagnosis of gastroenteritis in any of eight diagnostic positions. Individuals were allowed one gastrointestinal hospitalization in each pathogen category every 30 days.
[b]Excluding hospitalizations in which a cause is specified in any diagnostic position.
[c]Diarrhea (ICD-9-CM: 787.91), non-infectious gastroenteritis (558.9), ill-defined intestinal infections (009.0-009.3) and intestinal infections due to other organisms (008.8).
[d]Excluding *C. difficile*

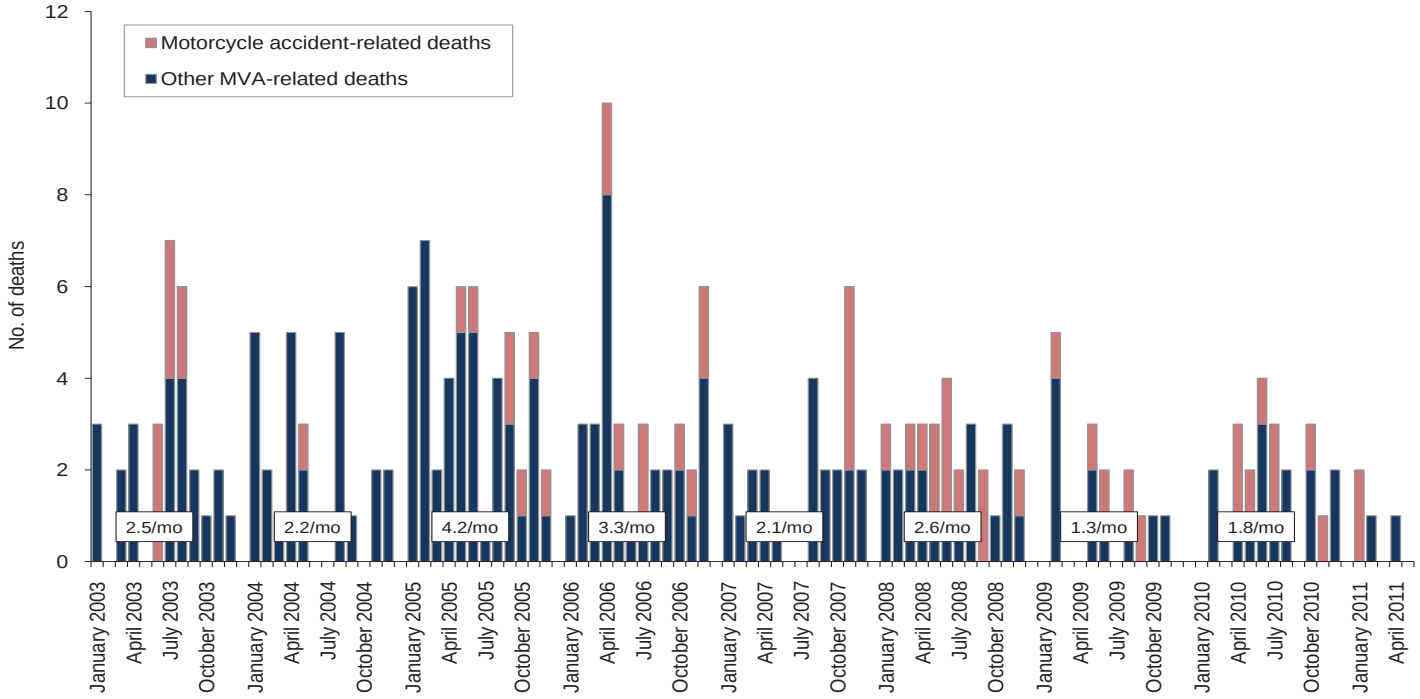
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - May 2011 (data as of 27 June 2011)

Motor vehicle accident-related hospitalizations (outside of the operational theater) (ICD-9-CM: E810-E825; NATO Standard Agreement 2050 (STANAG): 100-106, 107-109, 120-126, 127-129)



Note: Hospitalization (one per individual) while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days of a motor vehicle accident-related hospitalization.

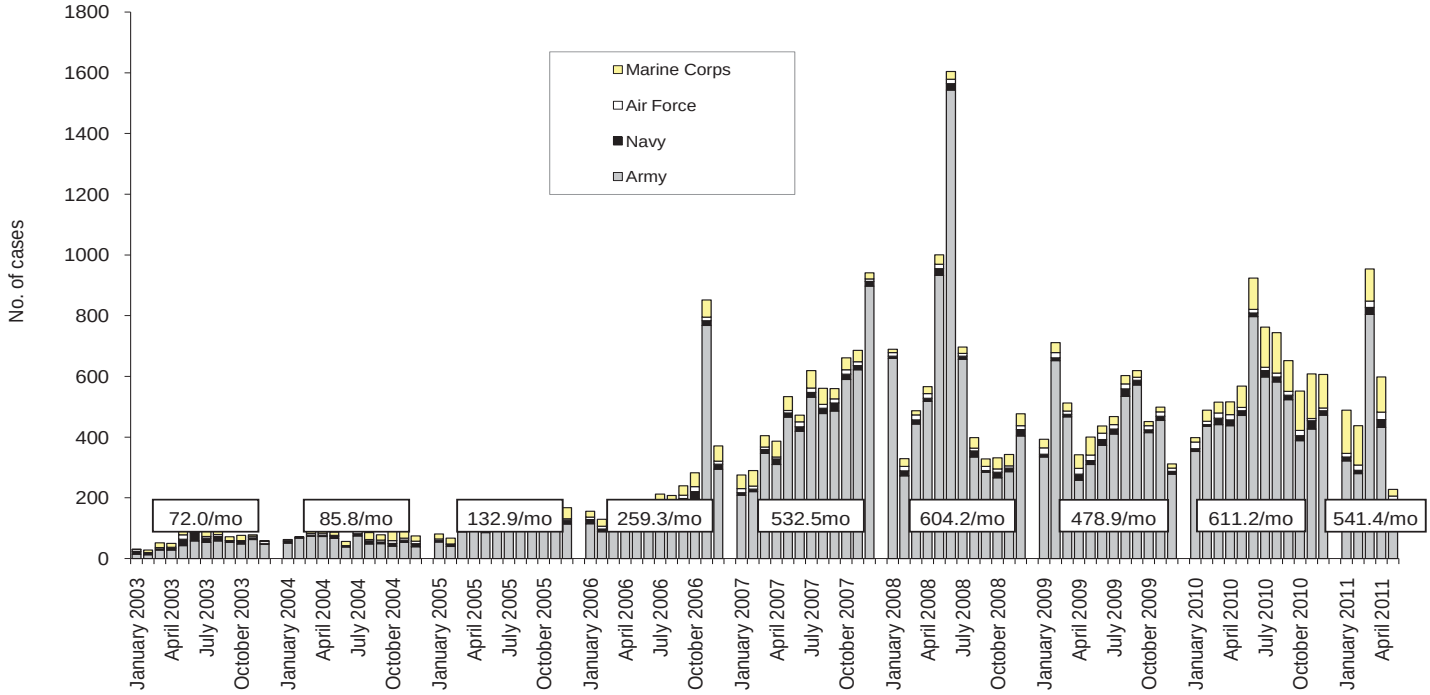
Motor vehicle accident-related deaths (outside of the operational theater) (per the DoD Medical Mortality Registry)



Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. *Medical Surveillance Monthly Report (MSMR)*. Mar 11;17(3):2-6.
Note: Death while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany within 10 days prior to death.

Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - May 2011 (data as of 24 June 2011)

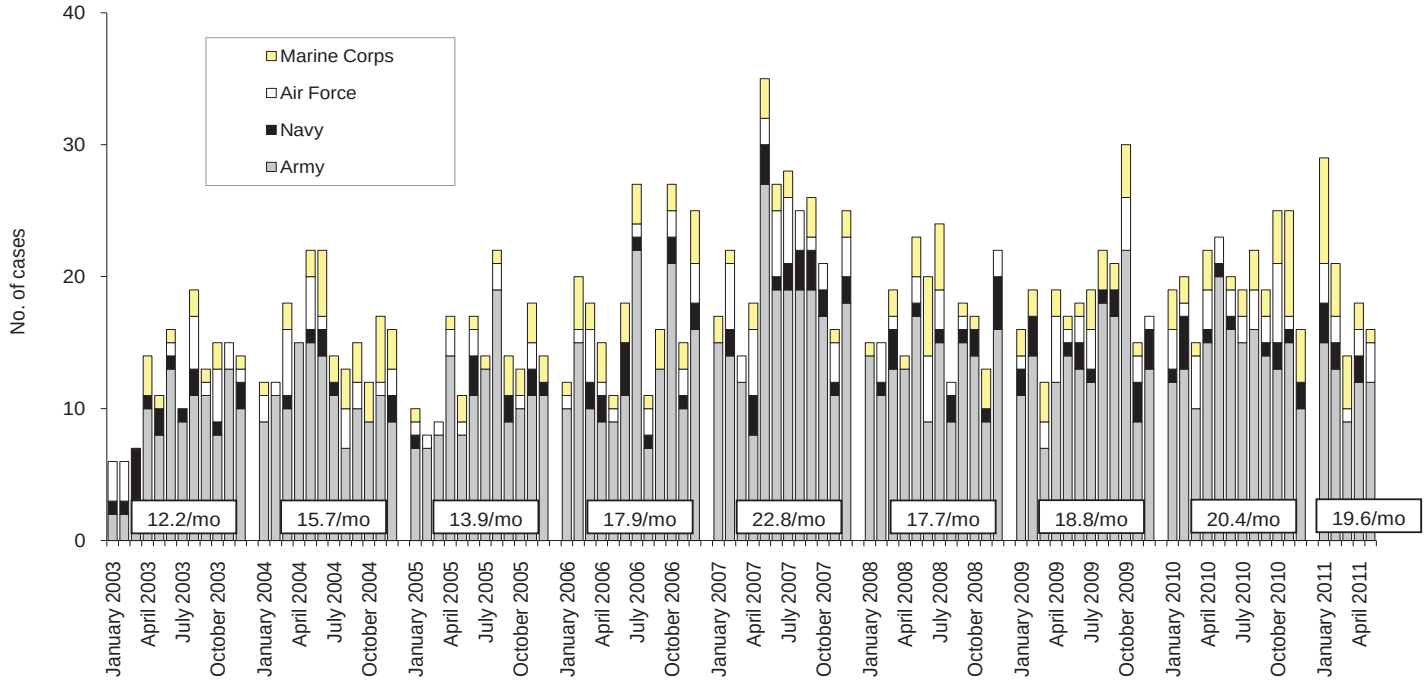
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.59_1-9, V15.59_A-F)[a]



Reference: Armed Forces Health Surveillance Center. Deriving case counts from medical encounter data: considerations when interpreting health surveillance reports. *MSMR*. Dec 2009; 16(12):2-8.

[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 2,858 deployers who had at least one TBI-related medical encounter any time prior to OEF/OIF).

Deep vein thrombophlebitis/pulmonary embolus (ICD-9: 415.1, 451.1, 451.81, 451.83, 451.89, 453.2, 453.40 - 453.42 and 453.8)[b]

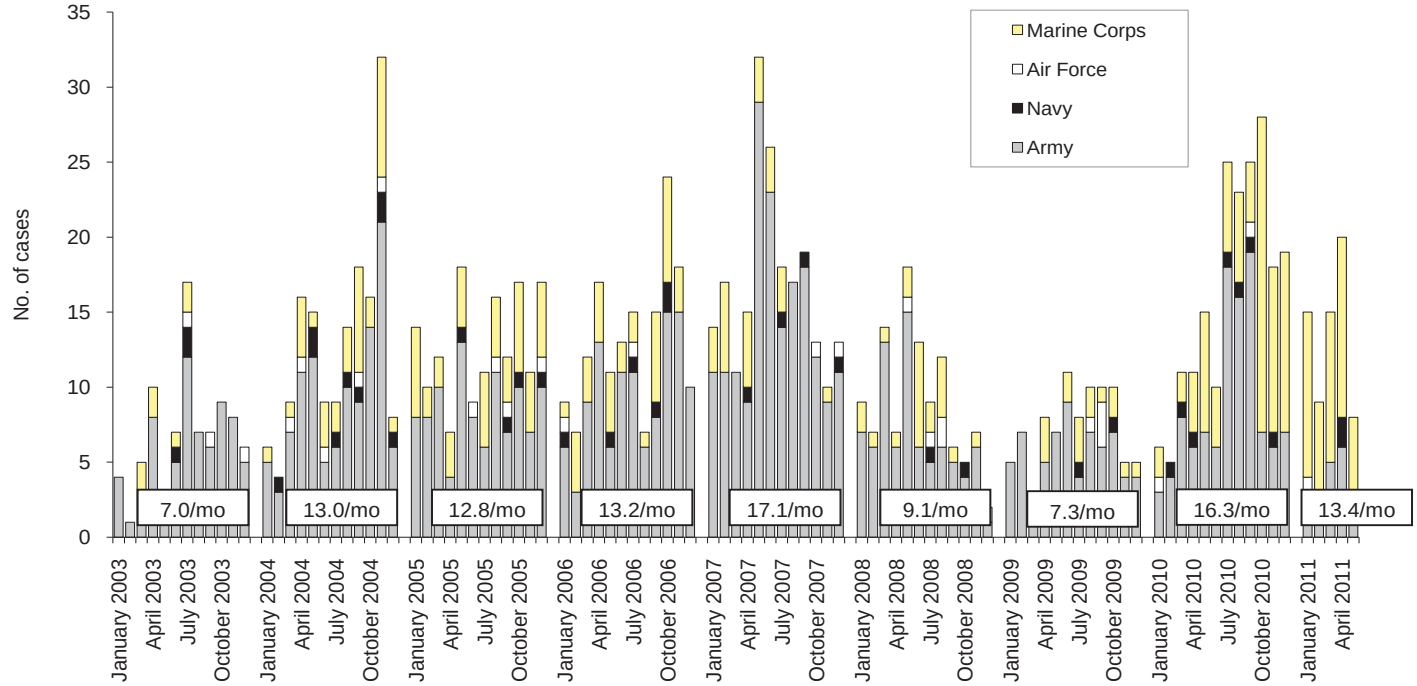


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from OEF/OIF.

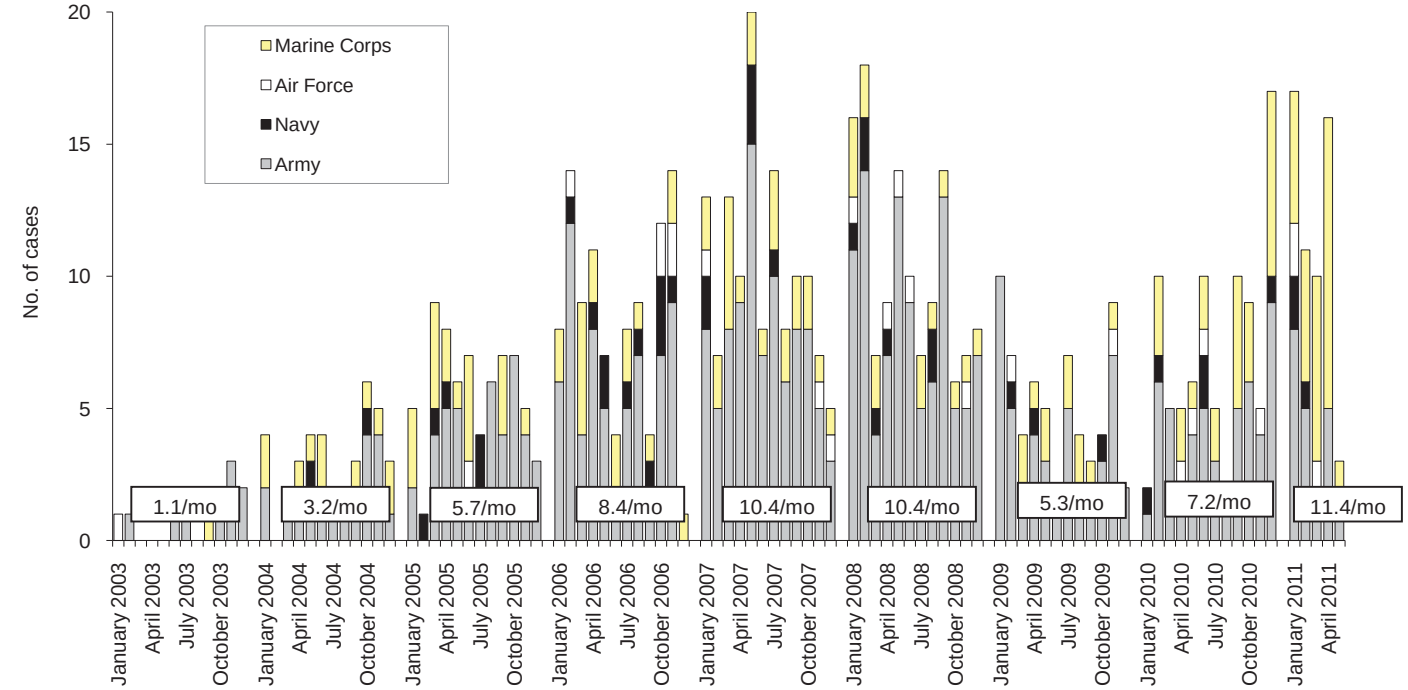
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - May 2011 (data as of 24 June 2011)

Amputations (ICD-9: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990-2004. *MSMR*. Jan 2005;11(1):2-6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF.

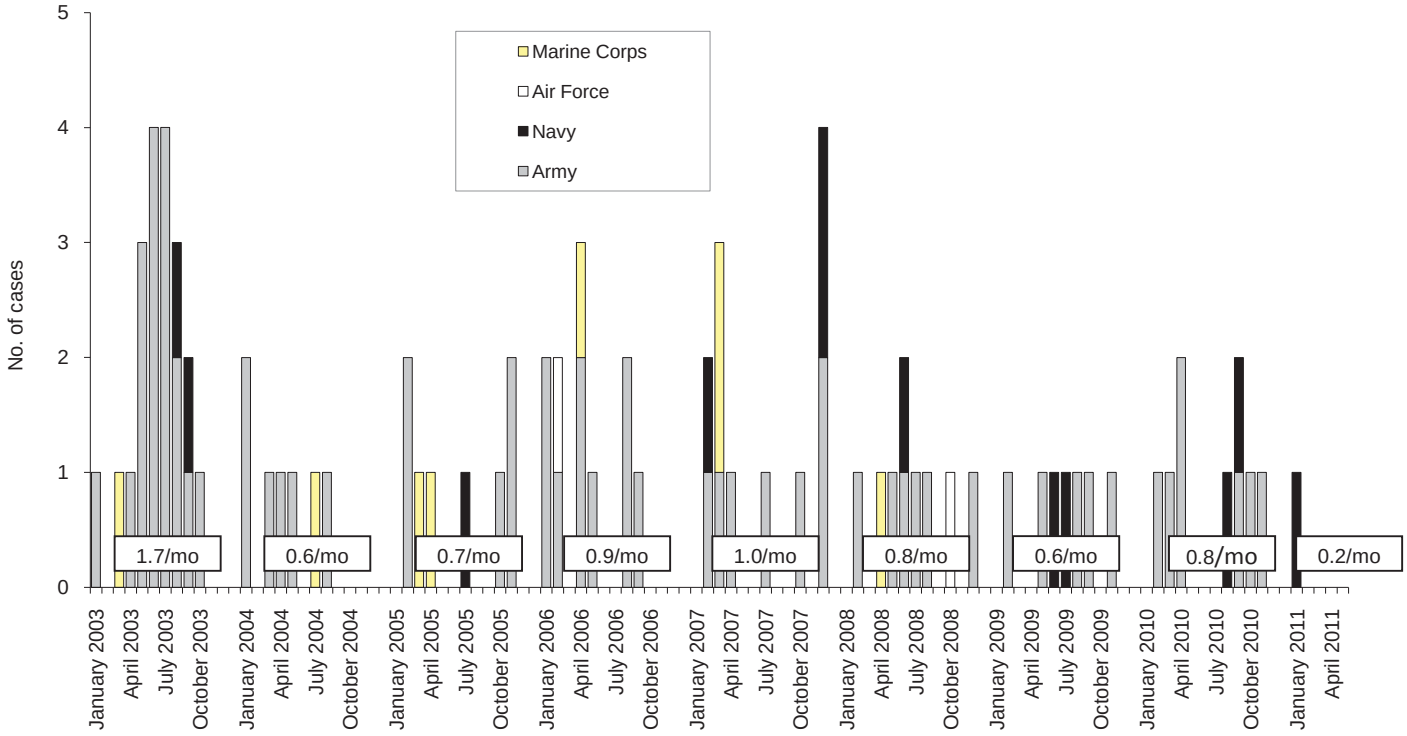
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]



Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from OEF/OIF.

Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - May 2011 (data as of 24 June 2011)

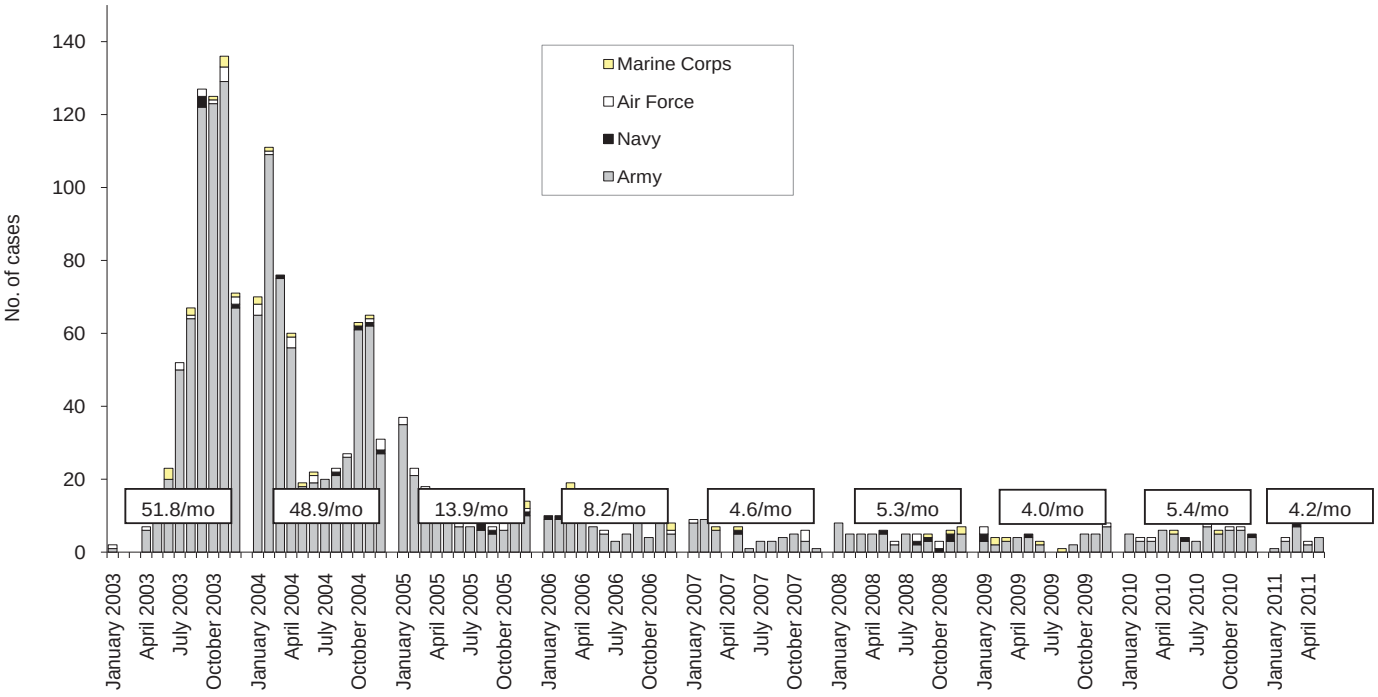
Severe acute pneumonia (ICD-9: 518.81, 518.82, 480-487, 786.09)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom, active components, U.S. Armed Forces, January 2003-November 2004. *MSMR*. Nov/Dec 2004;10(6):6-7.

[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF.

Leishmaniasis (ICD-9: 085.0 to 085.9)[b]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003-November 2004. *MSMR*. Nov/Dec 2004;10(6):2-4.

[b]Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during/after service in OEF/OIF.

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